SLASH DISPOSAL IN OAK-PINE STANDS OF SOUTHERN NEW JERSEY

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INTRODUCTION

Slash left from cutting operations in forest stands may have several important economic effects. It may kill established reproduction or provide unfavorable conditions for the establishment of new seedlings, thus preventing the restocking of the area with a desirable crop of timber. Slash may also create a serious fire hazard, providing fuel for intense fires that are difficult to control. Moreover, slash may impede fire fighting and double or triple the cost of suppression.

Because of these effects, different methods of slash disposal are often advocated. In some places they are even required by law. However, any method that requires removal or even additional handling of the slash becomes an extra cost that reduces the net value of the timber crop. Thus a management technique that does not necessitate slash disposal or employs a relatively cheap method is rather important in furthering the application of good forestry practices.

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A management technique that uses the selection system of cutting meets these requirements; yet it is not considered applicable in the oak-pine stands of southern New Jersey. True, the slash from the cutting of scattered mature trees, or even from small groups of such trees, does not appreciably increase the fire hazard. But such cutting favors the shade-tolerant oaks over the intolerant--but more valuable--pines.[2] Since one of the major objectives of management in these stands is to increase the proportion of pine, the selection system of cutting ought not to be used.

Even-aged management is more desirable. This calls for heavy harvest cuttings at the time when the stand is to be regenerated. Considerable volumes of slash usually result from these cuttings.

Recent research in southern New Jersey oak-pine stands indicates that the slash problem in these cuttings can be reduced or avoided by treating the stands periodically with light prescribed fires. These fires are used primarily to protect the forests against wild fires by destroying accumulations of fuel, to control unwanted hardwoods, and to prepare seedbeds favorable for pine. In stands where prescribed burns have been used, no slash disposal is needed after the harvest cutting. Furthermore, the cost of the prescribed fires should be no greater than the cost of getting rid of the slash by the methods usually advocated.

The authors of this paper compare the costs and relative merits of various slash-disposal methods and the prescribed use of fires as alternatives for obtaining pine reproduction.

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[2] Little, S., and Moore, E. B. The ecological role of prescribed burns in the pine-oak forests of southern New Jersey. Ecology 30: 223-233, illus. 1949.

THE FIRE HAZARD

THE STATE LAW AND ITS ENFORCEMENT

According to New Jersey law the slash from cuttings may, under certain conditions, be considered a public nuisance because it creates an extraordinary fire hazard. If a warden investigates an alleged hazard and decides that the slash is a special hazard, the responsible party must remove the hazard at his own expense within a specified time. Failure to do so makes him subject to a penalty of not less than $50 nor more than $400. Furthermore, this penalty may be imposed for each period of 5 days until the required disposal is made. Local wardens or other members of the New Jersey Forest Fire Service are required to observe and report hazardous conditions.

Enforcement of these broad legal provisions has varied. Usually the presence of slash in appreciable quantity within 100 feet of a well-traveled road is needed to warrant consideration as a special hazard. When such hazards are found, the owner or other responsible party is notified; he is asked to reduce the hazard within 100 feet of the road. Usually this slash is dragged away from the road and scattered, although in some areas it has been piled and burned, and in rare instances piled without burning. Very rarely has legal action been needed to force compliance. Thus, in actual practice slash disposal has usually been required only within 100 feet of a public road and has affected only small parts of cut-over areas.

THE NEED FOR SLASH DISPOSAL

The value of slash disposal as a fire-protection measure varies greatly, depending especially on the age, amount, and type of slash, and on the amount of shrubs and duff. The hazards from pine slash and slash of oaks cut when in leaf are greatest within a few months after the cutting, the exact period depending on the season and weather. Then the dried foliage is inflammable during dry periods, and woody portions have become somewhat dry. Later the foliage falls, reducing inflammability; but the wood becomes drier. Within 3 years after cutting much of the hazard is gone: even though the large woody pieces still burn readily during dry periods, most of the twigs and small branches have disintegrated. By that time, too, the slash has settled, and is no longer a serious obstacle to fire fighters.

Whether slash constitutes a hazard worthy of consideration depends to a great extent on the other fuels available. Usually the slash not subjected to special disposal methods is scattered haphazardly. Even if a portion of the slash is bunched so that a fire could catch and burn in it, a lack of adjoining fuel material could prevent appreciable spread of the fire. Thus, if the fuels in duff and shrubs are also discontinuous, the hazard remains low.

However, where the slash is on a thick duff and is mixed with many shrubs, it is a hazard on top of an already bad fuel hazard. Under such conditions slash may greatly increase the intensity of a fire and the difficulty of controlling it, because of the greater heat, the mechanical barrier of the slash to direct suppression, and perhaps the shower of sparks sometimes produced by burning slash. Where such dangers exist, special methods of slash disposal should be considered. Used over a sufficient area, they can be of great aid in suppressing any wild fires that may occur.

EFFECT OF SLASH ON PINE REPRODUCTION

ESTABLISHED REPRODUCTION

Slash may damage established reproduction in several ways. Slash can, of course, be so concentrated in certain spots that any pine seedlings there will die. Slash may also mechanically deform, injure, or break pine reproduction established prior to logging. However, it has been found that where reasonable care was taken in logging, losses were less than 10 percent. Where more than an adequate amount of pine reproduction is established, such losses will not appreciably affect the composition of the next stand.

Damage by slash may be more than offset in the Pine Region of southern New Jersey by the way it protects reproduction from deer browsing. There browsing of pine reproduction is common in many places. In some areas deer injure 50 percent or more of the seedlings.[3]

Clepper[4] found (in Pennsylvania) that lopped branches from weedings when laid over small trees afforded some protection from deer browsing. Consequently, one might expect that reproduction developing in the slash of a cut-over area would suffer less damage than similar reproduction occurring in the slash-free spots. The authors found this to be true in southern New Jersey. They made a study in a cut-over area where the slash from cutting all overstory oaks in the winter of 1946-47 was left where it fell. In the spring of 1949, 100 pine seedlings were examined, 50 that were unprotected by slash and 50 that were protected. The unprotected seedlings were apparently of similar age to the protected seedlings. Seventy percent of the protected seedlings, but only 4 percent of the unprotected seedlings, had never been browsed. Repeated or severe browsing was observed on 68 percent of the unprotected reproduction, but on only 6 percent of the protected seedlings.

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[3] Little, Silas, Jr. Deer damage to pine reproduction in southern New Jersey. Allegheny Forest Expt. Sta. Tech. Note 19. 2 pp. (Processed) 1937.

[4] Clepper, H. E. The deer problem in the forests of Pennsylvania. Pa. Dept. Forests and Waters Bul. 50. 45 pp., illus. 1931.

Pine seedlings are particularly susceptible to injury when they are small. In one study of the reproduction under an overwood, most of the pines severely damaged by browsing were less than 3.6 feet tall, and the greatest damage was to the trees less than 2.6 feet tall.[3]

Open-grown seedlings suffer most from deer browsing when they are 3 to 20 inches tall, and they reach relative immunity earlier than forest-grown seedlings. The difference is believed to be associated with the size of the shoots. Possibly the stouter shoots of the vigorous, open-grown seedlings are less digestible or more difficult to browse than the slender ones of the forest-grown seedlings.

The amount of damage, even to open-grown seedlings, is apparently correlated with the size of the shoot. For example, in the spring of 1949 the amount of damage was determined for four groups of 50 seedlings in slash-free parts of a cut-over area. Each group was composed wholly of seedlings in one of the following diameter classes: 1/16 inch, 2/16 inch 3/16 inch, and 4/16 inch or more. These diameters were measured about 2 inches below the terminal bud in undamaged seedlings or at the point of injury if the terminal had been browsed by deer since the 1948 growing season. Seedlings so injured included 84 percent of the trees with shoots 1/16 inch in diameter, 70 percent of those with a 2/16-inch shoot, 30 percent of those with a 3/16-inch shoot, and only 8 percent of those with the largest shoots.

Slash therefore serves a useful purpose when it protects the seedlings for the few years when they are small and susceptible to injury.

ESTABLISHMENT OF NEW REPRODUCTION

The effect of slash on the establishment of new pine reproduction varies greatly, depending on such factors as the type of seedbed prior to logging, the size of the cut-over area, the composition of the adjoining stand, the amount and type of slash, and the amount and timing of seed supplies.

Leafless hardwood slash that is scattered thinly over the area will usually not decrease the germination and establishment of pine reproduction if the seedbed before logging was mostly mineral soil. However,

if the cut-over area is small and the adjoining stand is mostly oak, hardwood leaves may be blown into the cut-over area, be caught by the slash, and thus create an unfavorable seedbed.

Coniferous slash and that from hardwoods cut when in leaf may drop sufficient foliage and add enough debris to the soil surface to decrease greatly the rate of establishment of pine reproduction, particularly if the seedbed was already rather unfavorable and a heavy cutting was made. In one study all the overwood of four oak-pine stands was cut with the exception of 10 pine seed trees per acre. There the lopping and scattering of slash on a forest floor typical of stands unburned for 10 to 50 years practically precluded the early establishment of new pine reproduction.[5]

However, because of the rapid decay of slash, its detrimental effect decreases so quickly that within 5 years it is hardly noticeable. Consequently, slash hinders the establishment of reproduction most immediately after cutting.

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[5] Little, S., and Moore, E. B. Mechanical preparation of seedbeds in converting oak-pine stands to pine. 1949. (Unpublished ms., Northeast. Forest Expt. Sta.)

RECOMMENDED SLASH-DISPOSAL METHODS

ON PRESCRIBE-BURNED AREAS

In areas that have been prescribe-burned one or more times before the final harvest cut, no slash disposal may be necessary. This is particularly true of areas where several prescribed burns have been made at periodic intervals.

Where advance pine reproduction has resulted from prescribed burning, and a heavy cut is made, slash can be left where it falls as long as care is taken to prevent excessive injury to reproduction during the logging operation. The slash will protect the young pines somewhat from browsing animals, and it will not materially worsen seedbed conditions for the establishment of additional new seedlings. Hence, special measures of disposal are not necessary.

Under dense stands, however, there may be relatively little advance reproduction--even though prescribed burning had been practiced--and so a two-cut harvest of the stand may be desirable to promote restocking of the area. In some of these areas the slash from the first cutting and from freshly fallen litter will provide enough fuel to carry a wild fire before a seed crop occurs on the residual stand. Then another light prescribed burn should be used, but with no attempt to consume all the slash. After enough reproduction has become established, the second and final cut may be made. In the second cut, no attention to slash disposal is needed other than to prevent excessive injury to advance reproduction.

ON AREAS NOT PREVIOUSLY PRESCRIBE-BURNED

In areas not previously prescribe-burned, removal of the slash by burning is usually a desirable practice. In such areas the usual forest floor has not permitted the establishment of sufficient pine seedlings before cutting to form the next crop. Letting the slash lie, or lopping and scattering it, decreases the rate of establishment of additional pine reproduction. If enough seed trees are present, adequate reproduction of pine will eventually become established, but a period of 10 years may be required if the slash is not destroyed. Moreover, hardwood growth, always ready to take over the site, has to be controlled for a longer period.

Hence, in most areas the lengthened "rotation" and the greater cost of controlling hardwood growth make removal of the slash a desirable practice.

Slash removal may be coupled with other measures to improve the seedbed and thus obtain adequate amounts of pine reproduction in a relatively short time, particularly if the treatments are made in seed years. One alternative is the broadcast burning of slash. Chapman[6] recommended the use of slash fires in the late summer of a good seed year for loblolly pine as a measure that would favor the establishment of pine reproduction and lessen the competition from hardwood reproduction. Slash fires in late summer have not been tried in New Jersey, but similar fires in the winter or spring have been tested. These fires have not appreciably reduced the competition from hardwoods, but they made the seedbed more favorable for the establishment of pine seedlings.

Another alternative is the use of machinery. Bulldozers may be used to expose the mineral soil to improve seedbed conditions,and at the same time to bunch the slash. Many New Jersey landowners have tractors, disks, and plows, and if any use of machinery were made, they might use their own. However, most of this farm equipment cannot be used effectively for seedbed preparation unless the slash has already been removed; otherwise, the disks tend to ride the slash, or the plows to become clogged. For such slash disposal the piling and burning of slash would usually be more satisfactory than broadcast burning, chiefly because the large pieces of slash are not consumed in broadcast burns.

Just which method is more advisable apparently depends in part on the timing of seed years. Large amounts of pine reproduction were obtained by the use of machinery just prior to good or fair seed crops, but where the seed crops were poor or light during the 3 years after treatment, a broadcast burn of the slash gave about as good results.

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[6] Chapman, H. H. Management of loblolly pine in the pine-hardwood region in Arkansas and in Louisiana west of the Mississippi River. Yale Univ. School Forestry Bul. 49. 150 pp., illus. 1942.

RELATIVE COST AND MERIT

Costs

Of the different methods presented, the cheapest of course is not to dispose of the slash at all; but that can usually be done only on the areas where prescribed fires have been used previously. The cost of prescribed burning might therefore be compared with that of slash removal. The usual range in cost of prescribed fires has been from 8 to 40 cents an acre per burn (based on $1 per man-hour). Experienced crews have burned extensive tracts for as little as 5 cents an acre, whereas inexperienced crews have incurred costs as high as 41 cents per acre. Thus, if five periodic prescribed burns are made before harvest cuttings, costs between $0.40 and $2.00 an acre can be expected.

In contrast, the piling and burning of slash is rather expensive. Cost records of this work in areas where all overstory trees except pine seed trees were cut indicate that hand piling and burning of slash will there usually require 15 to 20 man-hours ($15-$20) per acre, or about 1.5 man-hours per cord. Slightly more than half of the effort is spent on the piling.

Broadcast burning of slash-covered areas is cheaper than piling and burning the slash, but the cost of broadcast burning varies greatly. It is affected particularly by the size of the area, the amount of necessary line preparation, and the intensity of fire. Light fires that consume little of the slash are usually less expensive than hotter ones, chiefly because less line preparation and less patrolling are needed. The cost on most areas is greater if care is taken to prevent damage to pine seed trees. In one 30-acre tract where this care was not necessary the broadcast burning of slash cost 40 cents an acre, exclusive of line preparation. However, the burning of other tracts has cost more, and the broadcast burning of slash on 1-acre plots by crews of the Civilian Conservation Corps has cost several dollars per acre. Thus, for broadcast burning of slash-covered areas the range in cost may be from $0.40 to $2.00 per acre.

Relative Merits

The various methods of handling the slash result in different degrees of fuel hazard, particularly during the first few years after the harvest cutting. The relationship is as follows.

Treatment of area	Hazard
Areas where light fires had not been prescribed:	
Slash destroyed, seedbed prepared by machinery	Very low
Slash piled and burned, no seedbed preparation	Medium
Slash burned broadcast	Low, changing rapidly to medium
Areas on which light fires had been prescribed periodically	Low

After any of the treatments, the fire hazard increases as vegetation restocks the area, but the rate of increase varies greatly. The fire hazard increases at a relatively slow rate on areas that have been periodically prescribe-burned or where machinery was used to expose the mineral soil. It is also slow in the spots where slash was piled and burned, but these spots cover only 10 to 15 percent of a cut-over area. On the remaining unburned portions the fuels were not reduced and continue to be a medium hazard. This is similar to the hazard that develops within a few years on broadcast-burned areas, where the single fire greatly reduces temporarily, but does not eliminate the fuel in shrub and duff.

In general, the periodic use of prescribed fires prior to harvest cutting is more satisfactory than special methods of slash disposal after cutting. Properly used, these fires promote more prompt and adequate restocking of areas to pine reproduction, thus tending to shorten the time needed to grow a new crop of timber. Furthermore, the cost of the periodic prescribed burns is about the same as the cost of one broadcast burn of slash and is far less expensive than piling and burning the slash. In addition, the periodic use of prescribed fires is of great value in protecting stands from possible losses to wild fires.[7] This kind of forest management over a period of years is appreciably cheaper and more effective than desperate remedial measures made at the time of harvest cutting.

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[7] Little, S., Allen, J. P., and Moore, E. B. Controlled burning as a dual-purpose tool of forest management in New Jersey's pine region. Jour. Forestry 46: 810-819, illus. 1948.

SUMMARY

Slash left from cuttings in oak-pine stands in southern New Jersey may create an appreciable fire hazard under certain conditions, and State laws provide broad powers that may be used in requiring disposal of slash. However, slash disposal is usually required only within 100 feet of public roads. The actual hazard from slash is usually important only in areas where there is a relatively dense understory of shrubs and a fairly continuous cover of duff.

In many areas slash does not greatly damage established pine reproduction. If reasonable care is taken in the logging, usually not enough established pine reproduction is killed or damaged to alter appreciably the composition of the next stand. On the other hand, the presence of slash may protect seedlings from browsing deer.

The effect of slash on the establishment of additional reproduction varies, and so too should the disposal of the slash. Where the forest floor is already unfavorable for the establishment of pine seedlings, the addition of slash will further decrease the rate of establishment; but where the seedbed is mostly mineral soil, slash usually has little effect. Hence, slash disposal is generally not necessary on areas that have been previously prescribe-burned, but is advisable on unburned areas. The broadcast burning of slash is far cheaper than piling and burning, but the latter method has been more satisfactory where the usual types of farm machinery, such as tractors and disks, were used in further improving the seedbed for pine reproduction.

The most satisfactory and cheapest way of dealing with the slash problem is the periodic use of prescribed burns before harvest cuttings. These light fires are used in the management of oak-pine forests in southern New Jersey to protect the stands against destructive wild fires, to create favorable seedbeds for pine, and to repress unwanted hardwood reproduction. They offer a solution to the slash problem at no extra cost, whereas other solutions calling for the destruction of slash require a cash outlay.

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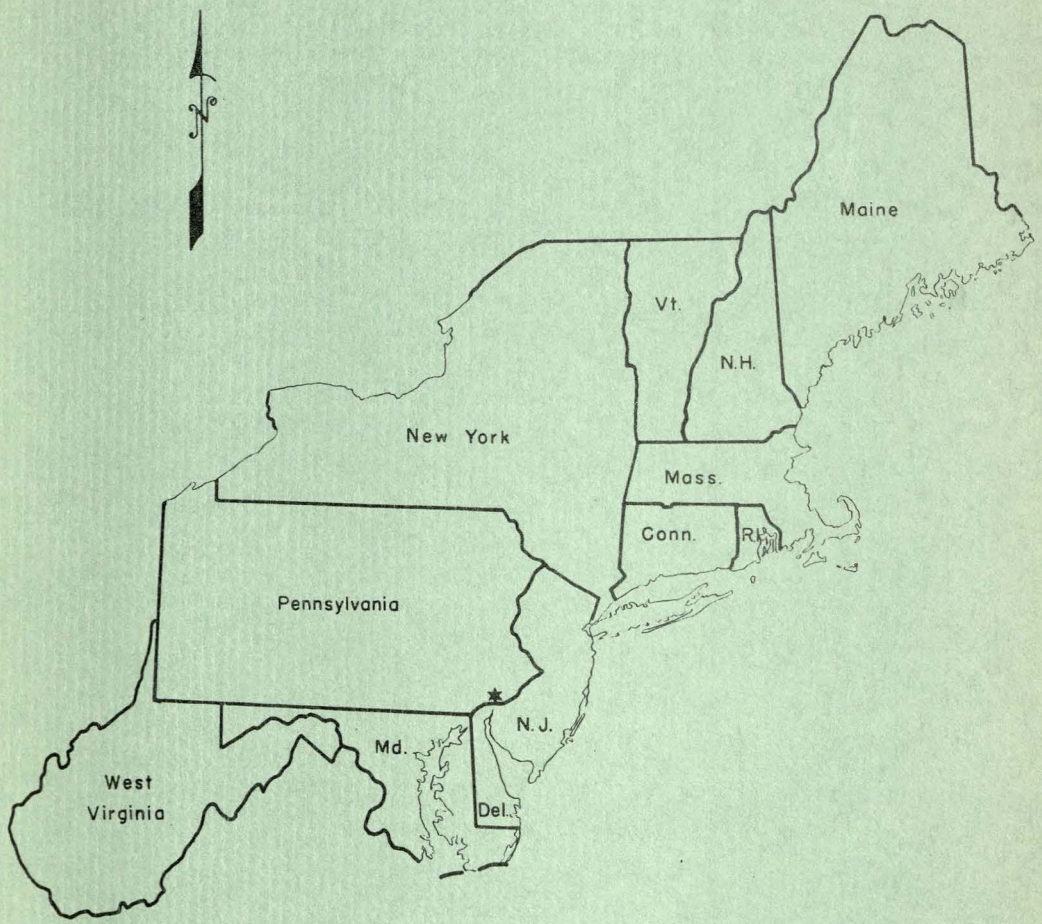

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